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Fast Washout, Aligned LA–ICP–MS, and Quantification

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Following a protracted campaign developing fast-washout ablation cell ("fast cells", washout time to 1% < 50 ms) for LA–ICP–MS we are now exploring the impact that fast washout has on quantification. While the benefits of fast washout have been shown previously, it mostly results in an improvement to spatial resolution of images, reduced measurement time, and increase in peak signal intensity. The initially obvious application of fast cells has been for imaging, which is a powerful and useful technique with a wide range of applications in the earth, material, and biological sciences[1].

When attempting to quantify images, or indeed use fast cells for rapid spot analysis, the main issue caused by using fast cells with a sequential mass spectrometer, such as a quadrupole, is the prevalence of aliasing. While some measurement strategies can mitigate this problem, the resulting conditions will be sub-optimal for the application.

Our approach[2] is to align firing of the pulsed laser with the sweep time of the single-detector mass spectrometer. We call this new technique "aligned LA–ICP–MS" and it can be implemented by way of an external circuit that monitors the mass filter position of the mass spectrometer in real time and fires the laser as required.

In this work we present results from our ongoing development program for fast cells and its intersection with research[3] into aligned LA–ICP–MS, show data that addresses differences in quantification that arise from fast washout, and try to answer whether aligned LA-ICP-MS is able to resolve these differences. Of particular interest is variable aerosol transport due to sample geometry, as well as the high peak plasma loading caused by ablation with fast cells. In summary, we attempt to state whether "pretty pictures" produced by fast cells can be successfully quantified, or not.

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[2] Norris, C. Ashley, et al. *Journal of Analytical Atomic Spectrometry* 36.4 (2021): 733-739.

[3] Gilbert, S, Glorie, S, Norris, C (2024, August 8–11). *EWLA* Conference 2024, Ghent, Belgium